



Psychological Bulletin

EDITED BY

HOWARD C. WARREN
PRINCETON UNIVERSITY

JOHN B. WATSON
JOHNS HOPKINS UNIVERSITY

AND

JAMES R. ANGELL, UNIVERSITY OF CHICAGO (*Editor Psychological Monographs*)

WITH THE CO-OPERATION OF

J. W. BAIRD, UNIVERSITY OF ILLINOIS; E. F. BUCHNER, JOHNS HOPKINS UNIVERSITY; R. DODGE, WESLEYAN UNIVERSITY; S. I. FRANZ, GOV. HOSPITAL FOR THE INSANE; IRVING KING, UNIVERSITY OF IOWA; J. H. LEUBA, BRYN MAWR COLLEGE; R. MACDOUGALL, NEW YORK UNIVERSITY; MAX MEYER, UNIVERSITY OF MISSOURI; R. M. OGDEN, UNIVERSITY OF TENNESSEE; I. W. RILEY, VASSAR COLLEGE; C. E. SEASHORE, UNIVERSITY OF IOWA; E. J. SWIFT, WASHINGTON UNIVERSITY; J. H. TUFTS, UNIVERSITY OF CHICAGO; W. M. URBAN, TRINITY COLLEGE, HARTFORD; M. F. WASHBURN, VASSAR COLLEGE.

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THE
PSYCHOLOGICAL BULLETIN

THE LOSS AND RECOVERY OF CONSCIOUSNESS
UNDER ANESTHESIA.

BY PROFESSOR AND MRS. DAVID SPENCE HILL,
Peabody College for Teachers, University of Nashville.

"The phenomenon of the waning of consciousness under an anesthetic is familiar to every physician, yet it is entirely probable that no introspective records have been taken from patients who have submitted themselves to the operating table," writes Dr. Elmer E. Jones, in the *PSYCHOLOGICAL REVIEW* of January, 1909 (Vol. XVI., No. 1). The reasons for this lack of data are designated to be the unsuitable condition of the patient owing to suffering, anxiety or some intense emotion; likewise the nauseating effects of chloroform; and again, physicians do not regard the physiological phases of anesthesia as having great significance. The field, however, seems rather fruitful to Dr. Jones since "it may throw some light upon the stability and deep-seatedness of the various sense impressions and ideas and their tenacity under the deteriorating effects of this powerful drug." Jones is also of the opinion that a thorough, experimental study of the waning of consciousness under anesthetics will throw much light on the psychology of death which while not of "very much pragmatic value is nevertheless of interest, because it is the experience through which all must pass and probably is the phenomenon which is more universally feared than any other strictly human experience."

Upon the morning of May 29, 1909, an operation was performed upon the present writer at the Deaconess Hospital of St. Louis. With the above described attempt in mind, the writer determined upon introspection of both the waning and awakening of consciousness under the influence of anesthetics administered for the sake of surgical operation. He could not attempt a series of systematic and prearranged tests similar to that of Jones; the memoranda that follow therefore describe

the spontaneous mental content immediately before and after anesthesia, as objectively observed in the utterances of the patient which were recorded and supplemented by his introspective recollections. His determination was simply to maintain to the limit of consciousness an alert attention to sensory, affective, ideational and motor processes; in addition to this scientific attitude he must confess to some intention of inhibiting if possible the foolish prattle and movements that some one had suggested might appear during anesthesia. This last reservation is amusing when compared with the record [C.] below.

The Loss of Consciousness. — At nine o'clock during the evening of the same day, the writer dictated his memory of what occurred before the operation. These notes were afterwards found correct so far as the observations of two of the surgeons and one nurse who were questioned could testify. This part of the record follows:

10:20 A. M. Patient was given hypodermic injection of heart stimulant, placed upon hospital carriage and removed to operating room for a minor operation. Feelings of excitement and some apprehension. Greeted surgeon acquaintances and was introduced to one stranger about whom he inquired facetiously. Became genuinely interested in rapid preparations and wonderful cleanliness of the place; apprehensions seemed to vanish. Noticed the stifling air and requested anesthetist to remember patient's asthmatic tendency. The anesthetist administered with a cone a few drams of chloroform, followed by larger quantity of ether. The conversation was as follows:

[A.] H—, "What shall I do?"

Surgeon. "Breathe naturally."

H—, "Why, this is pleasant. Does not choke or stifle."

Surgeon. "Stop talking. Think about sleep."

H—, "Trying to use suggestion upon me?" (Mentally: "I will now begin to test my sensations and control." Pinches own fingers of right and left hand.) "My sense of touch is all right. I notice a quick throbbing, throbbing in my head. It is hardly like my heart beat." (Increased throbbing in head; suddenly observed a numbness in left hand, and so remarked.) "It is a question with me whether sensory or motor goes first." (Moves fingers and toes. Soon feels uncertain whether toes, which were becoming numb, were moving.) "Doctor, are my toes moving? Make sure it is not an illusion."

Surgeon. "Yes. Stop talking."

The voices became dull and inarticulate. The field of consciousness seemed to narrow rapidly. The memories of other days, etc., remarked by Jones were absent. There remained the conscious effort to jerk the toes, the throbbing in the head, the thick but not unpleasant

ant odor of ether, the yellow expanse of the cone over the eyes — all present as to a spectator. Although, like Hume, he failed to grasp the elusive ego, yet never was the writer more curiously aware of what Angell calls 'the one indubitable fact — the consciousness of self-hood.' The last memory here is of the following remarks :

H—. "Well Doctor it's getting me all right. I can't resist it."

Surgeon. "Fold your hands thus" (assisting).

Consciousness of self vanished with the fitting field already described.

The Recovery of Consciousness. — The anesthetic was administered at 10:25 A. M., and the first signs of awakening, other than the reflex of vomiting, occurred at 11 A. M. The intervening time is a blank. Preparations had been made at the bedside with Mrs. H. and the nurse for a record of the awakening of consciousness. Longhand was used, so there may be some omissions, although the writing was done very rapidly, using abbreviations. Except for these abbreviations and minor corrections, the record is here given verbatim.

Patient was brought in and became nauseated immediately. After vomiting, lay for 20 minutes in same position. He then called repeatedly for air; "Oh, please give me some air." Nurse said loudly, "Take deep breaths," and pressed his chest. Mrs. H. began to record now his rapid utterances.

[B.] H—. "No anesthesia in my hand (held up hands). Isn't that funny?

What I want to know is what sense department goes first. Why don't you help me? . . . I say this, I say this, I say this — Oh, poor devil. . . . You people won't get down half I tell you."

Mrs. H. "I am writing."

H— still lay with closed eyes. He ran on — "Hold up four fingers.

Why can't you do this? I am working for a psychological experiment.

Hold up four fingers, hold up four fingers, hold up four fingers. . . .

Dog gone it. . . . Doctors are all alike the world over. Where's J.

(Mrs. H.)? Precious girl!" . . . (Crying.) Eyes of H— here opened for first time. Seemed to be at himself.

Hearing this record read to him after 12 M. and thereafter, H— could not recall anything from the administration of ether up to this point in the record; in fact, definite recall dates from the algebraic sum cited in the following paragraphs [C.]. Even the experience remembered at 12 M. was more of an awareness of effort and mental struggle than a clear recollection of ideas. Succeeding this early stage of consciousness H—'s orientation was fair, but not constant until the moment cited further on [D.] when he told Mrs. H. to cease writing; and there the record ends. Resumed from above paragraphs it continued as follows, as his eyes opened :

[C.] "You mean to say that fool operation is over? What's the last thing I said?

What, what, what (many times; neither Mrs. H. nor nurse replied).

... I want to know; ... that's the way women do the world over. Name of young fellow that gave me dope? ... I felt it first in left hand (held hands up): then peculiar throbbing; is my hand moving — delusion? — I want you to answer some questions. ... Why in d— don't you answer me? I'll be d— if I am — (irrational) I want to get some scientific value out of this. ... Something to eat? ... I want to know how long I was under ... I will do an algebraic problem. ..."

At 12:10 P. M. same day H— designated about this point as being the first fully awakened consciousness definitely recalled. The algebraic problem was interfered with by nausea and vomiting. After the nausea H— continued very rapidly to say he could do the problem.

" $a^3 - b^3 = a^2b^3$ " (clenches fists) "I don't give a — I'll get it in just a moment. Oh, pshaw, what did I say, please help me ... I ask ... I will work it. Bother ... you people talk so, why don't you help me. ... In spite of ... $a^3 - b^3$, $a^3 - b^3$, well now, I want to factor. ... I've got it at last; $a^3 - b^3$, starts out $(a - b)$ times $(a^2 + ab + b^2)$. Now ... you bet ... I'll show you that. ... How's that operation?" Nurse, "all right." "You are a peach" (to the nurse). "Confound it, where's ... (Dr. John W. Vaughan)? I am sick at my stomach. ... Wish I could see my mother. Give me a glass of water; — would that be out of your manual (sarcastically to nurse)?"

H—. "Ask me some questions — a question regarding recent date."

Mrs. H. "When did we arrive here?"

H—. "Never was good at dates. Ask something else."

Mrs. H. "Where does M. live?"

H—. "New Orleans (correct)."

[D.] Here H— complained for first time of pain in the surgical wound. Said he, "Write that down. Perception of pain is good. Why don't you say something? ... I can count ... touch my right hand." (Mrs. H. then touched his left.) "No, that is my left. ... I can see color now, the walls are green. I see blue — no, violet." (Correct, Mrs. H. showed a violet work bag.) The nurse remarked, "I would not know the color." H—, "What, are you color blind?" H— attempted to sit up. H—, "I am sea sick — Oh, ... Now I am all right. Do not write down any more," etc., etc.

The differences in method of observation, in kind of drug used, in speed of operating, in the individuals and the fact that the awakening as well as the waning of consciousness is exhibited in the above record, of course prohibit a parallel comparison of results with that of Jones. In our instance with due realization of the fragile nature of the data the following considerations are suggested.

1. In waning consciousness diminution of hearing, smell and sight seemed to keep pace merely with the general pronounced narrowing of the field of consciousness; the patient heard or noticed

only the operator's voice, the odor of the drug, the yellow field of the translucent cone over his face. If he were to say the sense of touch departed first and that surrender of voluntary muscular control was nearly last, there yet remained to the final fading out of conscious experience an awareness of personal identity.

2. But owing to the factor of attention, sharply marked stages of the waning of consciousness and the successive breaking down of the senses are with difficulty defined with any degree of certainty, rather than clearly, as in case of Jones. It is true the numbness in the left hand was noticed first, but in the absence of definite tests there may have been unnoticed marked changes in the other senses. The succession of changes in sensations seemed more dependent upon the direction of attention than upon the objective modifications. In the nature of the circumstances attention was alert, intense and variable as ideas suggested this or that change. The uncertainty from this cause and from consequent illusions is shown in the data regarding the movement of toes. The patient at last felt unable to move them, he was conscious of being stupefied by the drug, said "Doctor, you've got me"—at this point the physician said "hold your hands" and this the patient did correctly and promptly, showing good motor control, upon the redirection of his attention by the suggestion [A.].

3. Our introspection shows nothing in support of sensations of innervation 'clearly felt to pass from motor centers.' True, the consciousness of effort to move the toe after touch and kinesthetic sensations in that member seemed absent was experienced, but it is by no means clear that this consciousness of effort was other than the strain and added sensations not completely eliminated, as assumed by Jones; or else in view of the presence of abundant ideational content the alleged innervation consciousness was merely of that stuff, and a part of the illusory and hallucinatory processes present.

On the other hand the persistence of motor ability in observation of both Jones and myself as witnessed in the waning of consciousness attests its fundamental position, and also that artificial sleep as well as natural sleep, as urged by Sidis, is most closely related to the cessation of voluntary motor ability. In going to sleep, almost at the last, though stupefied, the writer was able to hold his hands correctly and was able to move parts of the body.

4. The rapid thumping in the head when taking the anesthetic was pronounced; no cardiac signs were noted; the inhalations of the drug were pleasant, surprisingly so to the patient: barring the feelings of excitement at the outset, the general affective state during the wan-

ing of consciousness was pleasant. . Indeed, it may be described as a keenly interested, half-amused state of mind, mingled with a feeling of pathetic helplessness. These and the other considerations emphasize the marked individual differences that may appear in the reaction to anesthesia and shock.

The awakening consciousness seemed intermittent, a delirious conflict of automatic reactions and of rational movements and utterances which later were augmented by a vague sense of orientation where the patient opened his eyes and inquired about the operation [B.]. Full orientation seems to have been attained at length where the reporter is told to cease writing, although a few hours afterward and to-day it is difficult to mark the point of full awakening. The signs of awakening process began 35 minutes after administration; the nausea and vomiting and most of the dialogue [B.] seem to have been part of the blank. The condition at this stage is similar to the effect of post-hypnotic suggestion: the processes dominant during the waning of consciousness were resumed, including the holding up of hands. Although memory a few hours afterward failed to recall this stage of awakening the patient seems to have been at the time responsive to the presence and words of those at bedside. Where the point of definite memory is noted the experiences were by no means clear or detailed but fluctuating in vividness and detail. As the final waning of consciousness was closely related to the surrender of voluntary control, so also the awakening seemed to be characterized by wavering and finally by full voluntary control over movement. The ideational content during the recovery was a rapid flow of processes with erratic associations, a struggle of ideas toward full consciousness. The lowered inhibitions are seen in the lapses into slang, mild profanity and remarks of the nature of psychomotor action. The affective processes were predominantly disagreeable, aside from the nausea; there was a sense of struggle, of being baffled and a sense of determination to emerge predominant, in marked contrast to the experience before anesthesia. The sensation of pain was definitely felt and localized not until complete awakening, indicating the profound effects of the drug [D.].

We agree with Havelock Ellis that "the importance of this field for research has yet been inadequately realized" and that "definite figures are much better than general observations" (*Man and Woman*, p. 311 et seq.); but our experience gives a certain conviction, *i. e.*, a realization of the unique difficulties of reliable introspections with anesthesia, and of the peculiar danger of generalizations from indi-

vidual cases. The complicating factors are many, such as the individual bodily tendencies and habitual response to drugs, the varying effects of different drugs, the temporary mental and physical state of subject; and where unfavorable affective states are avoided in advance, the persistence by way of autosuggestion of the dominant experimental aims, which become factors in hallucination and illusion, and the ensuing paramnesia. One could hardly claim that such tests throw much light upon the phenomena of death, so manifold are its methods and conditions of approach.

COMEDY AND THE COMIC EXPERIENCE.

BY WINIFRED SMITH,

Columbia University.

The functional psychology is so new that there have been as yet few attempts to apply its principles to the field of art, although all the odd definitions, particularly those of literary criticism, need to be reinterpreted in terms of human activity. The laws that Aristotle in the *Poetics* drew from first-hand observation, and the later modifications of these laws into rules, have become so hallowed by repetition that they are not only accepted without question, but are placed in the category of all sacred things — existent not for an age but for all time. The drama has, of course, generally been allowed to be active in its nature, yet the force of such a concession has been largely destroyed by the old dualism which separates the art product from the society behind it, and the formalism which sets off each *genre* in a tight box of its own. Comedy, for example, was defined by Aristotle as the imitation of a ludicrous action; the ludicrous as a defect that is neither painful nor destructive. Developing these meager suggestions, later critical theory decided that comedy must 'begin turbulently and end happily,' must imitate the 'follies and foibles' of men and must exaggerate a little by making humanity appear 'worse than life.'¹ Of a piece with this is the old idea of comic pleasure as a 'sense of superiority,' the result of a comparison involving a distinct feeling of 'lower' and 'higher.' Now there is truth in both these statements, but a truth beclouded by habitual and unquestioning acceptance and in great need of modification and reformulation.

First then, we must admit that the comic experience does indeed involve a conscious 'feeling,' for it is more than the mere shock which produces laughter. There is nothing really comic in the instinctive guffaw that greets a fall or a piece of clumsiness on the street or on the stage; such a reaction is only the physiological result of a slight nervous tension suddenly resolved. The element of comedy, distinct from horse-play and farce, comes in, as Meredith years ago pointed

¹ Aristotle's *Theory of Poetry and Fine Art*, ed. by Butcher, 4th ed. (London, 1907), pp. 372 ff. For a convenient summary of later definitions of comedy, cf. Spingarn, *Literary Criticism in the Renaissance*, 2d ed. (New York, 1908), pp. 66 ff.

out, only when the laughter becomes thoughtful,¹ that is, in psychological terms, when the state of expectancy or maladjustment is not too uncomfortable to permit of intellectual criticism, and when this criticism, by finding the key to the situation, causes the tension to give way to harmonious activity. In short, the comic experience is of the same type as all other *successful* experiences; the sense of superiority is too narrow a term for it, unless we generously interpret superiority to mean triumph, not necessarily over a person but over a set of circumstances. Truly comic was the pleasure felt by a small girl whom not long ago I watched as she puzzled over her hand and glove. For the first time she had become keenly conscious of them as two objects; her brows were knit, her mouth was drawn, as she compared her own small fingers to the woolen ones; gradually she discovered the likeness between the two sets of things, and after some experiment she found out the secret—the glove fitted on the hand. Then, relaxed and bubbling with laughter, she several times pulled on and took off her glove, happily mastering the situation.

It was apparently in just some such simple form that the comic sense first appeared on the stage. Primitive dramatic art is so unorganized that it can hardly be said to consist of anything but a series of life-like situations, which, because of their practical and magical connections with tribal welfare, are vividly colored by tribal emotion. For this reason the earliest hunt dances and war dances—neither comic nor tragic in our sense of the words—are predominantly serious in tone.² Wundt suggests³ that the grotesque Mime, once freighted with solemn religious meaning, cannot be regarded as burlesque until its subject-matter has become so thoroughly familiar as to be no longer mysterious and sacred. When the attention of the tribe shifts from hunting to agriculture, the animal ceases to be looked upon as a sacred object and the hunt dance can be somewhat freely criticized; therefore, as the uncomfortably serious feelings aroused by the Mime break down before a realization that the rite is only an old custom, now unimportant to the tribal welfare, spectators and actors begin to take a comic pleasure in the disguises of the players. Not until then can the individual dancer venture to introduce changes into his part or attempt, by over-emphasis of certain features, to help the audience observe that he is not the bird or beast he represents. There is a real analogy here to

¹ *An Essay on Comedy and the Uses of the Comic Spirit* (New York, 1905), p. 56.

² Cf. Thomas, *Source Book of Social Origins* (Chicago, 1909), Part II., for descriptions of primitive plays.

³ *Völkerpsychologie* (Leipzig, 1900), Vol. II., Pt. I. and Pt. V.

the case of the child with the glove; in both instances a slightly uncomfortable puzzle is solved by a perception of the similarity and difference in two sets of things, in the one instance two sets of fingers, in the other the real actors and the beasts they represent. The resultant pleasure in each case is due to comprehension and mastery. This final harmony and the preceding moment of comparison seem to be the fundamental elements in the comic experience.

Doubtless the easy success of so primitive a comic appeal as 'disguisings and maskings' accounts for the survival of the device long after dramatic art had become a form of sophisticated expression. Yet this motif remains as a means to an end rather than as a chief interest in these later plays; the formula that explains its satisfactoriness must be applied to the 'developing action' of each piece if we would discover whether or not it is sound. In the usual phrase, a comedy begins in confusion and ends happily, often by means of a 'recognition'; according to the psychological restatement, a comedy presents the solution, by criticism, of a puzzling state of affairs — a readjustment of warring forces by the choice of a way out that makes for harmony. It follows that the subjects proper to comedy cannot be the great mysteries of life, the conflicts too severe to be easily criticized, but rather those lighter problems which because they have been partly worked out by society, are more familiar, are freer from emotion and therefore capable of an intellectual solution. But no matter how adequate to the problem may be the solving of a dramatic complication, the play will not be called a comedy unless the majority of its spectators agree that the conclusion is 'happy.' Although Ibsen's Nora closes the door of her *Doll's House* behind her, choosing the only way to self-respect from the indirections of her past life, the play is still regarded as a tragedy; this can only be because for most people it offends the sentimental ideal of 'woman's sphere' by its relentless exposure of how unfit for any sphere a protected 'doll' must be.

The value of a play, then, cannot be determined once and for all; it will shift with the changing interests of humanity. As we have seen the earliest appearances of the comic sense seem to have been dependent upon practical changes in social organization; the satiric element in the primitive burlesque was directed against old myths no longer useful to the people. In a little play described by Hirn,¹ a more insistent satire pillories an unsocial individual who had transgressed public

¹ *Origins of Art* (London, 1900), pp. 158-9. A girl who had eloped with an undesirable lover was forced to witness the realistic presentation of her misdeeds until she was reduced to tears of shame by the laughter of the audience.

morality. In this latter instance and in the passionate invective of Aristophanes, comedy voices group sentiment, tradition and the customs of the fathers. In a more civilized age it may be the chosen form of expression of a radical individual, a satirist like Jonson or Molière or Shaw or Ibsen. It is these later plays which are not classed as comedies by the audiences that first see them, because they present a point of view in advance of average public opinion;¹ but just as surely as the problem presented in them is solved satisfactorily by the dramatist, and as he is able to impose his ideas on his generation and on posterity, just so surely will his work take rank as comic. Unlike the purely destructive satirist whose bitterness makes him see things tragically, and equally unlike the farcical writer who cares only to rouse boisterous laughter, the great comic artist is a constructive thinker. He looks out on the world with the idea of solving its puzzles not by hasty revolutionary action, but by cool thought, by deliberate choice and by careful readjustment.

¹Cf. Baldwin, J. M., *Social and Ethical Interpretations* (New York, 1897), pp. 460 ff.

PSYCHOLOGICAL LITERATURE.

EXPERIMENTATION ON IMAGERY.¹

In current psychological discussion the problems centering about imagery have assumed a very considerable degree of importance. Paradoxical though it may seem, the very suggestion that images are less significant as psychological factors than we have been led to suppose has thrown imagery as a topic into the lime-light of psychological investigation. One encouraging thing about the whole discussion is the growing tendency to refer the issues to actual experimental tests instead of merely rehashing the logical aspects of the situation. In such investigation the most crucial point at present, both for psychology and for pedagogy, seems to be the question of the real function of imagery. On this question the main initiative is being taken by the negative side, since the burden of proof lies with them. Accordingly we have a constantly increasing number of experimental studies which aim to cast doubt at least on the functional value either of imagery in general or of some particular form of imagery.² Considering the intrinsic interest in this question as well as the extreme importance which is attached to the results for their pedagogical applications, a rather extended study of one such paper, which is in many respects typical of the group, seems justified. The aim of this discussion will be to discover, through a critical consideration of the data and the conclusions, in what sense we are to accept the inferences of this paper as experimentally justified, and to suggest certain lines of criticism which other studies must face before they can be altogether convincing, at least in their negative aspects.

Dr. Betts' paper is an attempt to approach the problems of the distribution and functions of imagery in a distinctly experimental and even quantitative way. The author divides his problems into two

¹ With special reference to the paper on 'The Distribution and Functions of Mental Imagery,' G. H. Betts. Teachers College, Columbia University Contributions to Education, No. 26, 1909, pp. 99.

² Note, for example, the following articles: Woodworth, 'The Cause of a Voluntary Movement,' *Studies in Phil. and Psych.*, Garman Commem. Vol., 351-392; Thorndike, 'The Function of Visual Images,' *Jour. of Phil., Psych. and Sc. Method*, IV., 324; Winch, 'The Function of Images,' *Jour. of Phil., Psych. and Sc. Method*, V., 337-351.

main groups: "(1) Those which grow out of the power to evoke images voluntarily; and (2) those which grow out of the spontaneous use of imagery in thought." Throughout the investigation large groups of relatively untrained subjects were used. (Sect. I., Exp. 4 was the only exception to this.) Introspection was taken 'as the only safe evidence of mental imagery,' *i. e.*, no so-called objective methods were used. The study was primarily concerned with non-verbal imagery.

In Section I. the questionnaire method was used throughout. For the first experiment, the Galton questionnaire as supplemented by Thorndike was used; in the remaining three, one of Dr. Betts' own construction was employed. The latter consisted of 150 questions distributed thus: 40 on visual imagery, 20 each on auditory, cutaneous, kinæsthetic, gustatory and olfactory, 10 on organic. Each image was graded with reference to its clearness and vividness on a scale of 1 to 7; 1 representing the highest degree, 7 signifying no image. The test was completed in one laboratory period. For Experiments 1-3 the subjects were Cornell College or Teachers College students who had had a certain amount of psychology; for Experiment 4 eighteen experienced psychologists served. The results were thrown into strict statistical form for comparison, and coefficients of correlation were worked out.

In the study of the spontaneous use of imagery in thinking two general methods were used: (1) the method of interrupted thinking, (2) the method of setting a problem and asking for introspection on the process involved in the solution. Twelve different experiments were used as follows:

Exp. 1. Imagery in simple association. A form of the 'opposites' test. The following are samples of the words used: integrity, veracity, unless, eloquent.

Exp. 2. Imagery and thinking of familiar objects. More properly an experiment in the thinking of the *names* of familiar objects. The subjects were asked to write the names (1) of the things they would see on the bed of the ocean if all the water in the Atlantic should suddenly dry up; (2) of the sounds they would hear in the midst of a great city; (3) of the things they liked best to eat.

Exps. 3-6 were more or less alike and may be summarized together. They were concerned with the imagery, other than verbal, used in the following operations: selection of five 'capacities' in which the subjects excelled; listening to a lecture on instinct; defining such words as religion, youth, happiness, etc.; answering the question: "Should the death penalty ever be inflicted?"

Exp. 7. Imagery in the simpler forms of thinking. Three problems of a very concrete character were given to the subjects: Of these the first two concerned physical objects, while the third was a problem in algebraic multiplication.

Exp. 8. Imagery in mental multiplication: the multiplication of one three-place number by another.

Exp. 9. Imagery and the discrimination of length of lines, pitch of tones, shades of gray.

Exp. 10. Imagery and the memory of unrelated characters. This consisted of two tests; in the first the subject wrote the letters as learned, while in the second he wrote them in a changed order. A report of introspection was asked for in the first test but not in the second, since it was thought that it was 'probably safe to assume that the process would be practically identical in the two cases.'

Exp. 11. Imagery and the interpretation of music. (1) Practically like the second test of Exp. 9. (2) and (3) Interpretation based on the reading of the score and on hearing the music played.

Exp. 12. Imagery and the enjoyment of literature. The subjects were asked to answer a series of questions on both the imagery and the imageless process involved in the reading of their favorite works of literature.

Even so brief a survey of these tests makes it evident that the majority of them emphasize the verbal processes in preference to any others. This is strikingly true for Exps. 1, 2 and 5, where the main object of the test is to get satisfactory words. Exps. 3, 4 and 6 also fall in this class since they deal with such abstract questions that their consideration might naturally be expected to take a predominantly verbal form. In Exp. 12 the reading process is considered, which is based on the actual presentation of words to the subject. One experiment (8) deals with numbers and one (10) with letters. Of the remaining four tests, one (9) and part of another (11) deal with the problem of discrimination. One test (11) deals with imagery for music, and one (7) refers to concrete situations in which physical objects are thought of as figuring. In the light of this classification of the tests the results obtained do not seem very surprising.

The general results may be stated briefly as follows: In Exps. 1-6 it was often reported that no non-verbal images appeared, or that those which did appear came after the solution was reached. No correlation was found between presence of non-verbal imagery and excellence in the tests. In Exp. 12 imagery is reported as present in a large number of cases but as not constituting the main basis of the

enjoyment. In Exp. 8 the majority of the subjects reported no imagery other than inner speech. In Exp. 10, 36 per cent. reported 'no imagery of any kind.' Moreover the results for this group were only slightly inferior to those of the group who reported visual images of the whole square, and were as good for the second test as for the first. In the tests on discrimination a fairly large proportion of the cases reported no imagery. The results for those reporting very distinct imagery and for those reporting no imagery were alike better than those for the subjects who reported weak and vague imagery. In the first test of Exp. 11, however, which was really a test in discrimination, a decided correlation was found between the accuracy of judgment and the use of auditory imagery. In the second and third tests of Exp. 11 a very large amount of imagery—visual, auditory and kinæsthetic—was reported. In Exp. 7, also, much imagery was reported, at least in the first two tests: *e. g.*, "All of the class reported images of the squirrel and the tree." For the third test, algebraic multiplication, 35 per cent. "reported no imagery, except that of internal speech."

From the mass of data gathered in the two sections certain far-reaching conclusions are drawn. On the question of distribution the author reaches the following as his main inferences:¹ (1) "Few if any are absolutely lacking in the power of voluntary imagery," and many have the power in a rather high degree. "Individual differences are found chiefly in the degree of clearness and vividness of the images." (2) "There exists a marked difference in ability in voluntary imagery between college students and specialists more advanced in years who are dealing chiefly with abstract lines of thought." (3) "Ability in voluntary imagery is distributed much more evenly among the different types of images than has been commonly thought." No evidence is found for the preëminence of visual imagery, which is so often asserted. (4) The range of voluntary imagery is, for most persons, considerably wider than that of spontaneous.

Since the question of distribution is of less central interest at present than that of function, we will pass over these conclusions very hurriedly, merely suggesting certain considerations which seem to us to threaten their stability. First among these is the treacherous combination of untrained subjects and an introspective task of extreme difficulty. In our opinion the author, while recognizing the dangers of the situation, greatly minimizes them. We believe them to be suf-

¹In our summaries of conclusions the order adopted is our own, not the author's.

ficient to render at least exceedingly dubious any inference as to the difference between the untrained subjects and the specialists.

In the second place, the significance of the statistics, as statistics, is lessened by the wide variations from the averages. The value of an average obtained with a variation of from 22 per cent. to 34 per cent. seems to us a matter for speculation.

Further, with reference to conclusions (3) and (4), there is the fact that the materials compared were not obtained by methods sufficiently alike to justify any conclusions from a comparison of the statistical results. For example, in the material used for the comparison of visual imagery with other forms we find the most specific and detailed questions asked with reference to the former and only the most general with reference to the latter. Yet all answers are given the same value in the statistics.

In the comparison of the range of voluntary imagery with that of spontaneous, a similar fallacy is found. In Section I, the range of voluntary non-verbal imagery is explored with great thoroughness. In Section II., on the other hand, the majority of the tests are predominantly verbal in character and accordingly furnish no adequate index of the actual range of spontaneous non-verbal imagery which might be stimulated by other tests. The data are, therefore, simply inconclusive on this point.

With reference to the functions of images we find the following conclusions emphasized: (1) 'Imageless thought' has been demonstrated; (2) imagery is not necessary nor particularly valuable as a mental standard in discrimination; (3) much of memory is accomplished without the use of imagery; (4) imagery, though present in a considerable degree, is less important than has been supposed for the enjoyment of literature; (5) no correlation could be found between excellence in voluntary imagery and excellence in college studies.

The following positive conclusions are also reached: Imagery appears in greatest abundance (1) where percepts would be of greatest assistance; (2) where our thinking is baffled.

Before accepting these conclusions as experimental gospel, however, a critical examination of the evidence is necessary. The general criticism of Section I. holds of course here: *i. e.*, the recognition of the fact that these results were obtained with relatively untrained subjects. There are, however, certain even more weighty objections to the present conclusions.

First, and in our opinion most important, is the confusion in the use of the term 'imagery.' As we have pointed out, the imagery con-

cerned in inner speech is wholly omitted from the introspective reports of the subjects. 'Imagery,' therefore, in the conclusions must always be understood as exclusive of verbal imagery. The author may claim that any confusion on this point is inexcusable, since he has stated his procedure clearly. That the confusion is not confined to the reader, however, is indicated rather strikingly by the following statement from the author's own summary: "Thinking can and does go on without the intervention of imagery, the mental content being made up of feelings of meaning, relation, intention, effort, identity, interest, pleasure, displeasure, etc."¹ If imagery is used here as exclusive of verbal imagery, we should certainly expect some mention of the latter in the enumeration of the elements in the mental content other than 'imagery.' Rather a large burden seems to devolve upon the 'etc.,' if it is to stand for this whole verbal content. If, on the other hand, the author is using the term 'imagery' in its broadest sense as including verbal imagery, his conclusion is absolutely unjustified on the basis of his experimental data.

In either case his sponsorship of 'imageless thought' loses its significance as far as any bearing on current discussion is concerned. 'Imageless thought,' understood as thought in which no imagery other than verbal is present, is apparently not the question at issue in most of such discussion. We say this with some hesitation, since the ambiguity noted here has been more or less prevalent among other writers on both sides of the question. If we take, however, the writings of Professor Woodworth and Professor Angell² as fairly representative of the two sides of the question, we may state with a reasonable amount of assurance that the 'imageless thought' for or against which they are contending is genuinely *imageless*, not the pseudo-imageless variety here demonstrated.

The fact that imagery was not found to be necessary as a mental standard in discrimination may be passed without comment, as there is already much experimental evidence for this fact.

The statement that much of memory is accomplished without the use of imagery must be taken in the light of what has already been said as to the restricted use of the term 'imagery.' The sharp line of distinction is peculiarly artificial here, since letters are concerned. It is true that there were questions on auditory imagery and also on 'any other kinds of images,' but there was no explicit reference to kinæ-

¹ P. 94. Cf. similar statement, p. 65.

² See especially: Woodworth, 'Imageless Thought,' *Journal of Phil., Psych. and Sc. Method*, III., 705. Angell, 'Thought and Imagery,' *Phil. Rev.*, VI., 648-649.

thetic imagery or motor innervation of the speech organs, factors which are especially apt to be overlooked by untrained subjects.

As far as the enjoyment of literature is concerned we believe that results here stated might be confirmed for a considerable number of subjects. That is, we believe it would be found that *illustrative* imagery would be absent or reduced to a minimum in a large number of cases, and that even where present it would not be the main source of enjoyment. The language, which is the source of much of the enjoyment, is given, of course, as a fact of perception. Appreciation of rhythm and movement, which is often significant, as indicated frequently in the introspective accounts quoted, is not given through 'imagery' in the author's sense of the term.

In this consideration of the conclusions we must not overlook the positive statements with reference to the functions of imagery. The first of these, that imagery appears where percepts would be of most assistance, is a sufficiently commonplace statement to pass without remark. It is, in fact, the point which has always been claimed as the great value of imagery.

The second point, however, is more distinctly a contribution to the present discussion. It is asserted, as a result of this series of experiments, that imagery has the greatest tendency to emerge at points where our thinking is baffled. We should take issue with the author only in his interpretation of this fact. The following statement expresses his attitude:

"If it should . . . develop that imagery appears in greatest abundance at the points where our thought is baffled, and refuses to flow on in its usual channels, it would seem to mean that abundance of imagery does not go along with the most efficient thinking."¹

Reference is also made to the fact that problems which were solved *easily* were usually solved with a minimum of imagery. All this we find exceedingly interesting. It sounds very much like the much-emphasized distinction between habitual and conscious activities. Undoubtedly habits are performed more easily and with less friction than activities which are consciously directed. We should hesitate, however, to assert on that account that the habitual activities are the more 'efficient.' If there is any truth in the view of functional psychology that consciousness appears only where the habits of the organism are inadequate to meet the situation, in other words where there is more or less bafflement, it is evident that we have good grounds for asserting that the function of imagery is closely parallel with that of

¹ Page 53.

consciousness itself. Where the process is largely habitual in type and consciousness is at a minimum, we find few images; where, on the other hand, the habitual activities are least able to cope with the situation and consciousness is most intense, we find the largest proportion of images. It is really what we should expect to find if the functions of images were coincident with that of consciousness.

The further point, however, is frequently made that a large proportion of the images present are 'irrelevant.' It is noteworthy here that the author always has in mind the logical aspects of the situation. Images are irrelevant if they do not lead up in a close logical sequence to the final results. The function which even such irrelevant images may serve as associative links of extreme importance is apparently entirely disregarded, or at least association is seemingly appealed to simply to explain the *appearance* of the 'useless' image.¹

In conclusion we may summarize what we consider the final upshot of this paper as an experimental study.

On the side of method it has several distinct contributions to offer: (1) It represents, in common with several other recent experimental studies, a reaction against the dependence on the 'objective' methods so much in vogue in the early investigations of these problems. (2) The emphasis on the distinction between voluntary and spontaneous imagery and the classification of experiments accordingly seem eminently desirable and suggestive, especially from the standpoint of the interpretation of the results. (3) The avoidance of the more distinctly habitualized movements in the tests on function is also worthy of note. This paper accordingly escapes one line of criticism which has been urged against certain other studies of similar import.

As far as the actual conclusions are concerned we would express the outcome thus:

I. *As to Distribution of Imagery.*—The experimental data justify in a general way the conclusion that the majority of persons have considerable ability in the voluntary summoning of images. They do not justify any conclusions as to the relative distribution in untrained subjects and experienced psychologists; as to the relative distribution of visual imagery as compared with other types; as to the comparative range of spontaneous and voluntary imagery.

II. *As to Function of Imagery.*—On the negative side we find justification for the following conclusions: (1) Thinking, especially of the more abstract type, may go on with no imagery other than verbal present. (2) Where actual perceptual material is presented, as in

¹ Note on this point Exp. 3, p. 62-3; Exp. 5, p. 65; Exp. 6, p. 69.

discrimination tests and in reading, the functional significance of *imagery* seems to be diminished in many cases.

On the positive side there are the following conclusions: (1) At points where percepts would be of great assistance non-verbal imagery seems very important. (2) Where thinking is baffled, *i.e.*, in the genuinely problematic situations, imagery is most abundantly present.

The specific bearings of this paper on current discussion have probably been indicated sufficiently in the course of the review. We would only add the general suggestion that all conclusions be scrutinized most carefully in the light of the data on which they are based. We can accordingly agree with the author most heartily in his assertion that "the section of descriptive and dynamic psychology which deals with mental imagery needs rewriting with the aim of better definitions of terms and functions and a better weighing of values."

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PSYCHOLOGY OF THINKING.

The Psychology of Thinking. IRVING ELGAR MILLER, Ph.D.
New York, Macmillan, 1909. Pp. xxv + 303. \$1.25 net.

Instructors in introductory psychology, logic and education will find this an exceptionally useful supplementary text for teaching the biological conception of the mind and the functional view of the thought processes. The book is especially timely because teachers are feeling more keenly the importance of a better introduction to the organic conception of the mind than is to be found in the usual general texts in psychology, and are recognizing also that the treatment of the higher mental functions from the evolutionary point of view has been wholly inadequate. The author states that the main outline of his book was developed in connection with his teaching of psychology and pedagogy at the State Normal at Milwaukee, Wis., where he was also supervisor of practice teaching. His interest in the reasoning process, however, began when he was teaching mathematics in a New England academy. It is fitting that he should have had the opportunity to present the essentials of his book at the summer school of the College of Education at the University of Chicago, for one recognizes throughout the 'seed thoughts' of Professor John Dewey, to which the author acknowledges his indebtedness. In proposing to treat only the thought process the author naturally restricts the field of the book so that it could hardly be used as an exclusive text in the

usual courses of study. Its form is essentially that of a text and its arrangement is especially well adapted for instructional purposes. With this as a beginning it should be possible in time to have an additional introductory course devoted to the process of adjustment through thinking, a psychology of logic. The reviewer would welcome such a course as a forward step in the science.

Three aims are apparent in the subject matter: to present the biological view of the mind, to develop that view in connection with the process of thinking, and to suggest how this better understanding of the thought process bears upon the problems of pedagogy and mental development.

1. The book opens with a presentation of the biological point of view. For students who are not specializing in genetic psychology, this general account of the place of the mind in evolution is probably the most useful to be found anywhere. Much of the student's difficulty with functional psychology is due to his not clearly understanding the biological view. Dr. Miller helpfully starts him by describing the general nature of an organism and of the process of adaptation. He then points out how certain essentials of an organism are found in the mind. In this connection he mentions the mutual dependence of the processes of consciousness acting in the adjustment of the organism and its environment, and the law of self-determination. He might well have brought together at this point a more complete description of the organic nature of the mind including the two prominent features of development and inheritance. The students fail lamentably to recognize the characteristics of an organism in consciousness, so that it is unfortunate that Dr. Miller has not attempted to summarize them more thoroughly. The general treatment of the significance of consciousness as the factor of variation, reconstruction and individual control in evolution, and especially of the conditions and functions of thinking compared with other modes of adjustment is ably carried out. It is very gratifying to find that in his general attitude toward evolution Dr. Miller is not satisfied with an interpretation which makes physical existence the end of the process as is too common in animal and plant biology. In fact, he does not hesitate to reverse the formula of Spencer by showing that man, instead of aiming only at adaptation to his environment, is, in his higher development, attempting to bring his environment into adjustment with his own ideals.

2. In elaborating the functional view of thinking, the author discusses four fundamental processes: imagination, conception, judgment and reasoning. The central idea of this discussion, which forms

the body of the book, is that from the implicit, unreflective form of thinking, typical in the trial and success method of learning, to the explicit form of reasoning there is an identity of function, but with a growing perfection of the tools of thought: the image, the concept and the judgment. It is in its improved account of the building up and use of the technique of thinking that this book will do much to make conception, judgment and reasoning more vital to the students. The author criticizes the traditional accounts of these functions which are merely descriptions of the results of the processes. Such static descriptions neither show the needs out of which the processes arose nor the functions which they serve. The traditional account of conception, for example, does not show its relation to any need. It supposes that we start with a lot of given individuals, that we compare them and select all the common characteristics, which we combine and hold before the mind, ignoring the others. This is faulty in that we do not start with given individuals, but with a vague, often unreflective, general notion which fails to meet a particular situation, and we observe, compare, and generalize not all the common characteristics but certain characteristics which bear upon our problem and help us to solve it. This concept we then use in similar situations until it again needs reconstruction. In deduction the movement of thought is in the direction of using our tools of thought, or concepts, while in induction it is in the direction of refining or perfecting these tools. Judgment arises from the need of evaluating an experience. Both judgment and conception are discussed in their explicit forms and as functioning in implicit, unreflective forms. The explicit forms are characterized by definite technique. The term reasoning he restricts to its explicit form, although he points out its resemblance in function to the unreflective type of thinking. It is not part of the author's intention to seek for the details of the thought process in its development as a work on genetic logic like Baldwin's *Thought and Things* does for advanced students. Dr. Miller, however, recognizes the heart of the difficulty of distinguishing the higher mental processes when he seeks to discover the locus of the specific problem which each process meets. That he has formulated descriptions of these problematic situations which will become orthodox for psychology is perhaps too much to expect, but he has certainly made some of the main distinctions clearer for undergraduates.

3. The practical application of the results of psychological analysis one feels is too often a neglected part of psychological texts. In making his applications, which the author does by extended illustra-

tions and by separate chapters, he has frequent opportunities to comment vitally upon various fallacious pedagogical ideas. The advantage of manual training, for example, is not in acquired motor skill, but in the fact that it gives the opportunity for a complete process of adjustment arising in a situation in which the child feels the demand for refining his activity and finds immediate use for his refined skill in producing results which he values. The author frequently points to the fallacy of isolating mental functions which are mutually dependent. When we have conceptual activity so cut off from the exercise of the imagination that the child cannot associate the word symbols of reading, for example, with concrete images, we have a sin against the organic nature of conscious processes. By understanding how concepts arise, if they are vital, one appreciates the uselessness of those that are given to the child ready made in the form of tenets of religious faith and moral precepts. So one understands better the advantage of postponing the learning of technical concepts so long as the vague unreflective notions of the child are adequate for the situations he can appreciate, also the value of the Socratic recitations in leading the pupil to realize the need of refining his general notions, and the importance of giving the pupils more opportunity for applying their new tools of thought. In making these applications the author is practicing what he preaches in a way that is thoroughly refreshing. There is no attempt to work out specific methods in education, but the bearing of the ideas is suggested sufficiently to let the reader feel that he is obtaining a refinement of his notions of the mind which is worth while.

In some of the psychological details there have been slight changes from the customary treatment, but on the whole the conceptions of the author seem to be thoroughly orthodox. The reviewer is inclined to approve the attempt to restrict the term instinct to specific tendencies for reaction, while impulse expresses both specific tendencies and such general tendencies as play, imitation, etc. We need a new word restricted to general hereditary tendencies. Perhaps a little too much confidence is shown in locating reflexes, automatic acts, instincts and habits in various levels of the nervous system. The idea of different levels of adjustment (unconscious, organic, and intellectual) with corresponding types of sensori-motor circuit, while it is in accord with good usage, lacks the evidence from neurology which we should like before asserting that the process of organizing habits without volition, as in the trial and success method of learning, goes on through the nervous mechanism of the subcortical centers (p. 82). In making a distinction between the stages in the develop-

ment of a concept the terms 'unreflective' and 'reflective' seem to be more definite and descriptive than 'psychological' and 'logical' concepts which the author uses for general headings. Logical concepts might also be regarded as psychological when the ordinary meaning of the words is taken.

On the whole the text takes from the pragmatic school of thought what is perhaps best in it, its refined psychological description of the way the thought process works. This form of description has been splendidly adapted to the use of students by a lucid style replete with illustrations. There is enough of originality to make it a real contribution to the teaching of introductory psychology and logic. When compared with other elementary biological treatments of thinking, such as are to be found in Angell, Thorndike, Judd, Bagley, O'Shea and others, one feels that this elaboration of the description and functional explanation of the thought processes will do much to clarify and make accurate the student's ideas of the higher mental functions and to show how this new understanding of the mind is valuable for explaining conscious action and for controlling adjustment.

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RHYTHM.

Experimental-Untersuchungen zur Lehre vom Rhythmus. KURT KOFFKA. Zeitschrift für Psychologie, LII, 1-109.

In order to obtain material for an analysis of the phenomenon of rhythm, the author has made a series of experiments upon twenty observers, employing the subjective method and visual stimuli.

Koffka finds the advantage of using a visual instead of an auditory stimulus to lie in the fact that the subject, being unacquainted with this form of rhythm, is better able to observe and analyze the different stages of its development than he would be in the case of auditory rhythm.

In the first part of the experiments, the stimulus consisted of a black strip, which was seen through an opening in a gray screen. One of ten discs, provided with openings of different sizes and different interspaces, was rotated behind the opening in the screen. The strip thus appeared intermittently, and by changing the discs and their rate of rotation many different forms of rhythm could be produced. By a skillful arrangement of the Schumann Zeitsinnapparat, batteries and induction, a Geissler tube was made to flash intermittently behind the ground-glass window of a dark box. By different combinations

of the contacts on the Schumann instrument, it was possible to produce different intervals between flashes.

Three different sets of instructions were used. (1) The observer was told to direct his attention to the black strip (or the light) and to describe the results of his introspection. Sometimes the stimuli were given rhythmically, at other times the rhythm was purely subjective. (2) The observer was told to combine the stimuli into groups of x . The rhythm was at all times subjective. (3) Only a few flashes were given and the observer was instructed to combine them into a rhythm, and, suppressing all outward expression, to continue this rhythm in thought, thus obtaining rhythm centrally produced. In the experiments under the last two sets of instructions, as well as under the first, careful introspection was required and every statement was noted.

The paper is divided into three parts, corresponding to the three different instructions.

Koffka sums up his conclusions as follows: Regularity is not in itself rhythm. The experience of regularity involves a judgment of equal time intervals on the part of the subject. Regularly occurring stimuli may be broken up into subjective groups, which are of the same nature as those corresponding to objective groups. The maximal number of members to a group is determined by the maximal duration of the primary memory image. A 'group' can consist of one member, the pause remaining in the margin of consciousness. Group building is never absent in rhythm. In order to have rhythm, however, one or more members of the group must be accentuated. The author finds accent to be an expression of that which all the subjects agree in calling 'activity.' This experience of 'activity' need not be simple in character. It is possible that further analysis will reveal many characteristics.

The method which Koffka has employed seems fully justified by the results. His conclusions, arrived at after an exhaustive analysis, are strongly supported by the material he has gathered.

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HEARING.

The Influence of Binaural Differences on the Localization of Sounds. H. A. WILSON and C. S. MYERS. *British J. of Psy.*, II., Pt. 4, 386-405.

This is a supplementary and more detailed report of investigations reported in 1907.¹ Using the principle and method employed by

¹ *Proc. Roy. Soc.,* 1908, A., Vol. LXXX., pp. 260-266.

Thompson¹ and later by More and Fry,² apparatus was constructed which permitted of more careful and thorough experimentation than either of the foregoing had obtained. A hollow tube, consisting of a combination of brass and glass tubing, was conducted to the ears. A hollow T-piece was introduced into this tube so that it could slide through a range of 60 degrees on either side of the median point. Into this T the sound from the tuning fork was received. By the aid of this apparatus they were able to show that the result of slightly moving the T from the middle (symmetrical) position, say towards the left, is to shift the apparent position of the tone of the fork from the median plane to that side of the head towards which the T-piece is moved. As the T-piece is moved still further towards the left this lateral displacement of the tone is reduced until a position is reached where the tone is again localized midway between the two ears. If the T-piece be moved still further to the left, the tone passes over to the opposite ear, and if it be still further moved in the same direction, the localization of the tone again changes, passing through every gradation until it is localized once more at the left, and so on. This series of changes can be repeated several times, the number depending upon the wave-length of the tone employed and the available distance through which the T-piece can be moved. Forks 128, 180, 240, 256, 320, 384 and 512 vibrations were used.

Their results confirm those of Lord Rayleigh,³ "that the localization of a tone of low pitch is dependent on the difference in the phase of vibration in which the tone reaches the two ears." They do not concur in the view that localization of such a tone is due to a direct recognition of the phase difference at the two ears. They contend that while binaural differences in phase are a *primary* cause of the observed lateral effects, these effects are ultimately referable to binaural differences in intensity, holding that:

A. The sound entering one ear is transmitted through the bones of the head to the internal ear of the opposite side.

B. The retardation in phase due to this ear to ear conduction is small.

C. The two sets of waves, at their meeting in one or the other ear, arrive from opposite directions.

D. The stimulus in either ear is a resultant of two vibrations; one communicating directly to the ear and the other indirectly to it

¹ *Phil. Mag.*, 1878, Ser. 5, Vol. VI., pp. 386-387.

² *Phil. Mag.*, 1907, Ser. 6, Vol. XIII., pp. 452-458.

³ *Phil. Mag.*, 1907, Ser. 6, Vol. XIII., pp. 214-231, 316-319.

through bone conduction from the opposite ear. A comparison of these resultants will determine the ear in which the tone is localized. If the resultant is stronger in the right ear the tone will be localized there, and vice versa; if the resultants neutralize one another the tone will be localized in the median plane.

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Some Data for a Theory of the Auditory Perception of Direction.

A. N. HOCART and WILLIAM McDOUGALL. *British J. of Psy.*, II., Pt. 4, 386-405.

This work consisted of a series of five experiments bearing upon the conditions of stimulation of the sense-organs which render auditory perception of direction possible. The experiments were conducted in the open air. Wax and plasticine were used from time to time to build up the artificial meatuses. The series led to the following conclusions: (1) Noises and complex tones are localized with greater accuracy than pure tones; (2) in the localization of complex tones both ears having artificial meatuses, there is a coöperation of some further conditions, in addition to the shells of the ears; (3) in the localization of noises, meatuses being blocked on both sides, conclusion of the second series is confirmed; (4) in monaural localization of pure tones the only operative condition is the difference of intensity of stimulation; (5) in monaural localization of noises of varying quality, the indications of the preceding series are very strongly supported, viz., that besides difference of intensity in the stimulation of the two ears, and the modification of the sound wave by the external ear in different ways according to the direction of its incidence, some other condition is operative. This is probably due to skin-sensation of the meatus, in coöperation with movement-tendencies in the constitution of local signs.

J. C. RICHTER.

Das Problem des sogenannten sechsten Sinns der Blinden. L.

TRUSCHEL. *Archiv f. d. ges. Psychologie*, 1909, XIV., 133-178.

The author shows by experiments, that the state of being conscious of nearby, motionless bodies, often attributed to an unknown sense, is not dependent on tactile-thermal stimuli, nor on warmth stimuli. He concludes that it is due to a stimulation of the ear.

GEO. R. SCHREIBER.

UNIVERSITY OF IOWA.

APPARATUS.

Apparate für Psychologische Untersuchungen. SPINDLER und HOYER.

It is not customary to notice catalogs in scientific journals, but we have here one which deserves special mention. (1) Because it is the most pretentious effort that has yet been made by any firm to collect and make psychological apparatus, and (2) because the catalog contains very elaborate descriptions and directions for use of apparatus making it indeed a serviceable manual in the selection of apparatus.

It has been written by Dr. Hans Rupp, assistant in the Berlin laboratory. Psychologists must recognize the generous enterprise on the part of the makers in this elaborate publication and it marks an epoch in psychology that we now have a firm of such magnitude devoting its energies to the manufacture and distribution of psychological apparatus.

CARL E. SEASHORE.

UNIVERSITY OF IOWA.

SYMPATHY.

Ueber reflexive Sympathie. FRÄULEIN VON RENAULD. Archiv f. d. ges. Psychol., X., 264-310.

This article is a psychological interpretation of certain phases of human relations. Though the various facts of social experience which form the basis of the conclusions are not unfamiliar, they are, nevertheless, presented in a new way to show their bearing upon the topic under consideration.

Human life may be provisionally divided into the period of impulse or instinctive life, and that of reason. A recognition of the large part played by instinct is necessary to an understanding of the relations of man to man. The solutions of the problem of social relations given by ethics, metaphysics, economics, natural laws and evolution culminate, according to the author, in a psychological interpretation. She agrees with Hume that human minds are like mirrors to one another and reflect (*reflexive Sympathie*) their inner life to each other.

Only in so far as we feel into or interpret into others a consciousness like our own, do they exist for us as conscious beings. The growth of the power of communication is shown in the development of language with its comprehension, in a child. A word is learned by connecting a sound picture with an optical picture of the thing or event to which the word is applied. Similarly the names for feelings

are gradually understood. This development reaches its final stage when the child becomes able to read.

The content of a communication may be one of three things: (1) one's thoughts, concepts and judgments, (2) one's will, (3) one's wish. The effectiveness of a communication is determined by, first, the ability of the person communicating to impress; second, the availability of the nature of the communication; third, the efficiency of its content; and fourth, the motive of the communication. One factor alone may make the communication impressive, but if several or all of the factors work together the impression increases in strength accordingly. A certain degree of harmony among the factors is indispensable.

After pointing out the difference in the three possible kinds of communication according to the content, the author proceeds to discuss the second kind, the communication of one's will, the development of which is the purpose of the paper. If *A* communicates his will to *B*, *B* makes *A*'s will his own, provided no contrary motives or reasons arise. *A*'s will undergoes a change in *B* and becomes for the latter an obligation. The will of a person is thus communicated and obligation results in commands, prohibitions, promises, and agreements.

The effectiveness of the command depends upon the four factors which determine the impressiveness of the communication. The motive for commanding and for obeying is perhaps a onesided or mutual interest. The strength of a prohibition is also a matter of who, how, what and why. The feelings of right and obligation are present here as well as in other kinds of communication of the will. Promising binds one to his word. It is an unconditional obligation. Ceremony added to a promise tends to make it more binding. Security and trust are the elements of right and obligation in a promise. The author believes that the strength of the feelings of gratitude and revenge depend upon the four factors determining the effectiveness of a communication.

The direct personal communication of the will leads to the impersonal will expressed in custom and in statute laws. Custom forbids and commands. It is the expression of the will of many and is the conservative social element. Habit and statute laws are also the expression of the will. The laws of a nation are the expression of the will of a power which exists in a certain community of persons, and which is able eventually to enforce its wishes. It comes nearest to a purely personal command.

EDWIN C. LUEDDE.

WASHINGTON UNIVERSITY, ST. LOUIS.

PULSE AND EMOTION.

Certain Pulse Reactions as a Measure of the Emotions. ISADOR H. CORIAT, M.D. *Journal of Abnormal Psychol.*, 1909, 261-279.

Dr. Coriat, conceiving that the physiological accompaniments of emotions are vasomotor, respiratory, or secretory, attempts to show how pulse acceleration corresponds to the rise of emotion. He gives mental diagnoses and graphic pulse records of four cases of psychasthenia, two of dementia præcox, one of the paranoiac state, and one of hysteria. These abnormal subjects being, after psychological diagnosis, more easily played upon emotionally than the typical laboratory subject, appear to show in their reactions more characteristic types of response. Key words, or association test complexes, more decisively play havoc with the weakened powers of inhibition and the loosened emotion works itself out.

The general plan of the investigation was by means of a metronome to induce the state of 'experimental distraction' reducing the pulse rate thereby from 8 to 20 beats per minute. If at such time adroitly the key words related to the critical turning points of the subject's irregular emotional history be spoken, these suppressed experiences may now flood the mind. The pulse curves in all cases show this hastening when an emotionally significant word in the series is reached. Merely intellectual or sensorial states do not produce such changes. As the subject recovers the pulse curve approximates gradually the normal even when reacting to these at other times weirdly significant stimuli. Thus the author is inclined to think that we have an objective test of the patient's abnormal mental state.

A related thesis with which the author closes his paper is that in dementia præcox, for example, the emotions may in a certain sense be active even when the subject may complain of apathy. Unconscious emotions, as unconscious memories, 'can cause the same physiological reactions as conscious' ones. The apparent emotional apathy is superficial. These emotions, unattached, that is, inarticulate, fleeting, dissociated free mental lances, settle indiscriminately upon any promising hallucinatory phenomena. Such a state is marked by incoördination between the emotions and the concepts.

CHAS. HUGHES JOHNSTON.

UNIVERSITY OF MICHIGAN.

PSYCHOLOGY OF RELIGION.

Magic and Religion. J. H. LEUBA. Sociolog. Review, 1909, II., 20-35.

Two theses are supported in this article: (1) The primary forms of magic probably antedated religion; (2) whether magic antedated religion or not, religion arose independently of magic; they are different in principle and independent in origin. Magic is classified (on a power basis) as follows: (1) Absence of any idea of a power belonging to the operator or his instrument and passing to the object of the magical art. The idea of power is here reduced to the least possible complexity. (2) A power, not itself personal, is supposed to belong to the magician or to his instrument or to particular substances and to pass into or act upon the object. (3) Cases in which the magician feels that his will effort is the efficient factor.

All the essential conditions of magic are found in the natural activities of children and if a similar mental attitude be assumed to exist in the case of primitive man, it is sufficient to account for the presence of magic but makes religion impossible since religion includes the *abstract idea* of power. While magic and religion may be combined as in a prayer addressed to a personal being, they never fuse. Magic and religion are alike differentiated from science in that science acknowledges definite and constant quantitative relations between causes and effects, relations which completely exclude the personal element and the occult.

J. J. TAFT.

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A. AUSTREGESILLO. (Publicações de 'Brazil Medico') Rio de Janeiro, Besnard Freres, 1909. Pp. 7.

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The Harveian Oration on Experimental Psychology and Hypnotism : 1909. GEORGE H. SAVAGE. London, H. Frowde, 1909. Pp. 44. 1/- net.

History of Medieval Philosophy. MAURICE DE WULF. 3d ed. Trans. by P. COFFEY. London and New York, Longmans, Green & Co., 1909. Pp. 519.

La langue internationale et la science. L. COUTURAT and others. Paris, Delagrave, 1909. Pp. 65.

NOTES AND NEWS.

THE Western Philosophical Association and the North Central Section of the American Psychological Association will hold meetings at the University of Iowa, Iowa City, on March 25 and 26. Separate sessions will be held Friday afternoon and Saturday morning, and a joint session Saturday afternoon. Friday evening there will be an address by the President of the Western Philosophical Association, Professor Carl E. Seashore.

OWING to his absence from this country, Professor J. Mark Baldwin has resigned the presidency of the seventh International Congress for Psychology, which it is proposed to hold in the United States in 1913.

WE learn that Professor Joseph Jastrow, of the department of psychology of the University of Wisconsin, has accepted the general editorship of a new series of psychological manuals for the general reader, to be known as the 'Conduct of Mind Series.'

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